

**Samsung Secret**

Product Information

DATE : 26. Mar. 2012**SAMSUNG TFT-LCD****MODEL : LTA460HN08-W(FHD,60HZ)**

The Information Described in this Specification is Preliminary and can be changed without prior notice

LCD Business

Samsung Electronics Co . , LTD.

MODEL

LTA460HN08-W

Doc. No

05-000-G-20120326

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*** Revision History****Samsung Secret**

| Date | Rev. No | Page | Summary |
|---------------------|---------|------|--------------|
| 26. Mar, 2012 | 000 | - | First Issued |

General Description

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Description

LTY[Z]460HN05 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 46.0" is 1920 x 1080 and this model can display up to 1.07G colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV, Display terminals for AV application products, and High Definition TV (HDTV).

Features

- RoHS compliance (Pb-free)
- High contrast ratio, high aperture ratio, fast response time
- SPVA (Super Patterned Vertical Align) mode
- Wide viewing angle ($\pm 89^\circ$)
- Full HD (1920 x 1080 pixels) resolution (16:9)
- Low Power consumption
- WLED (White Light Emitting Diode) Backlight
- LVDS (Low Voltage Differential Signaling) interface

General Information

| Items | Specification | Unit | Note |
|---------------------|--|-------------------|--------|
| Module Size | 1048.9(H _{TYP}) x 603.3(V _{TYP}) | mm | ±1.0mm |
| | 26.2(D _{MAX}) | | |
| Weight | 10800(Max) | g | |
| Pixel Pitch | 0.53025(H) × 0.17675(V) * 3 | mm | |
| Active Display Area | 1018.08(H) x 572.67(V) | mm | |
| Surface Treatment | Haze 0.8%, Hard-coating (2H) | | |
| Display Colors | 8+2bit – 1.07G | colors | |
| Number of Pixels | 1920 x 1080 | pixel | |
| Pixel Arrangement | RGB Vertical stripe | | |
| Display Mode | Normally Black | | |
| Luminance of White | 430 | cd/m ² | Typ. |

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1. Absolute Maximum Ratings

1-1 Operating Condition

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

| Item | Symbol | Min. | Max. | Unit | Note |
|-------------------------------|-----------|---------|------|------|------|
| Power Supply Voltage | V_{DD} | GND-0.5 | 13 | V | (1) |
| Module Storage Temperature | T_{STG} | -20 | 60 | °C | (2) |
| Operating Temperature | T_{OPR} | 0 | 50 | °C | (2) |
| Shock (non – operating) | S_{NOP} | - | 30 | G | (4) |
| Vibration (non – operating) | V_{NOP} | - | 1.5 | G | (5) |

Note (1) $T_a = 25 \pm 2$ °C

(2) Temperature and relative humidity range are shown in the figure below.

a. 93.8 % RH Max. ($T_a \leq 40$ °C)

b. Maximum wet-bulb temperature at 40 °C or less. ($T_a \leq 40$ °C)

c. No condensation

(3) Polarizer will not be damaged in this range, even though abnormal visual problems occur in T_{SUR} range.

(4) 11ms, sine wave, one time for $\pm X$, $\pm Y$, $\pm Z$ axis

(5) 10-300 Hz, Sweep rate 10min, 30min for X, Y, Z axis

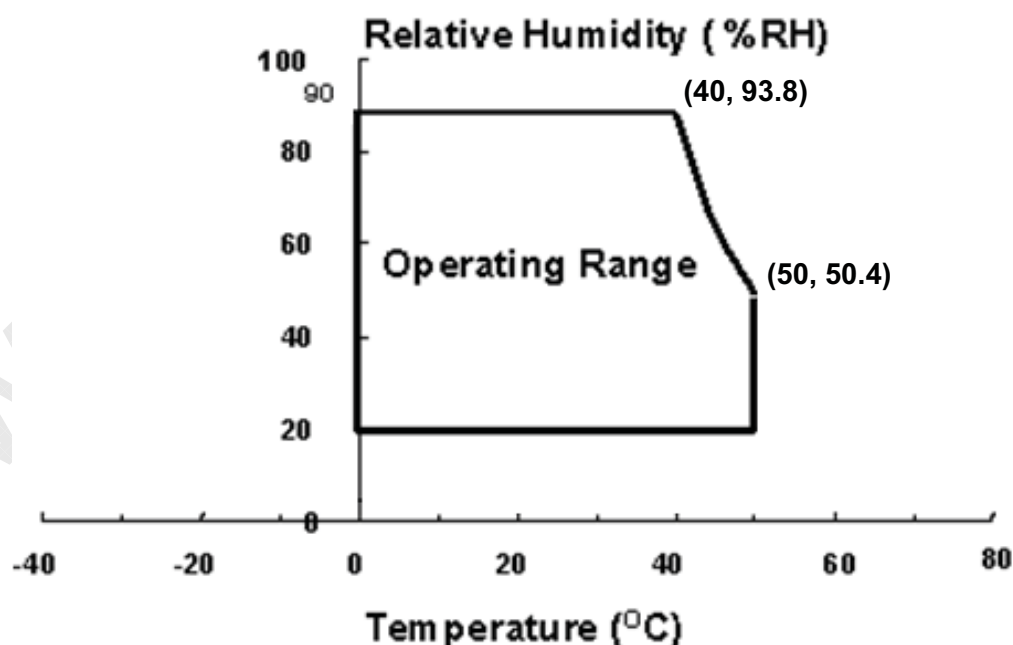


Fig. Temperature and Relative humidity range

2. Optical Characteristics

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The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON BM-7,SPECTRORADIOMETER SR-3

(LED Input Current = 130mA, Ta = 25 ± 2 °C, VDD=12V, fv= 60Hz, f_{DCLK}=148.5MHz, Dim = 100%)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|--|--------------|------------------|---|---------------|-------|---------------|-------------------|--------------------|
| Contrast Ratio (Center of screen) | | C/R | Normal $\theta_{L,R}=0$ $\theta_{U,D}=0$ Viewing Angle | *3000 | 4000 | - | | (3) SR-3A |
| Response Time | G-to-G [AVE] | Tg | | - | 8 | 16 | msec | (5) RD-80S |
| Luminance of White (Center of screen) | | Y _L | | 360 | 430 | - | cd/m ² | (6) SR-3A |
| Color Chromaticity (CIE 1931) | Red | Rx | | TYP. -0.03 | 0.641 | TYP. +0.03 | | (7),(8) SR-3A |
| | | Ry | | | 0.331 | | | |
| | Green | Gx | | | 0.313 | | | |
| | | Gy | | | 0.613 | | | |
| | Blue | Bx | | | 0.155 | | | |
| | | By | | | 0.056 | | | |
| | White | Wx | | | 0.280 | | | |
| | | Wy | 0.285 | | | | | |
| Color Gamut | | - | - | 70 | - | % | (7) SR-3A | |
| Color Temperature | | - | - | 10000 | - | K | (9) | |
| Viewing Angle | Hor. | θ_L | C/R≥10 | 79 | 89 | - | Degree | (8) EZ-Contrast |
| | | θ_R | | 79 | 89 | - | | |
| | Ver. | θ_U | | 79 | 89 | - | | |
| | | θ_D | | 79 | 89 | - | | |
| Brightness Uniformity (9 Points) | | B _{uni} | | - | - | 30 | % | (4) SR-3 |

* CR = (White at point ⑤ of Note 2) / (Most Dark Point of Black Pattern at area ① of Note 2)

Note (1) Test Equipment Setup

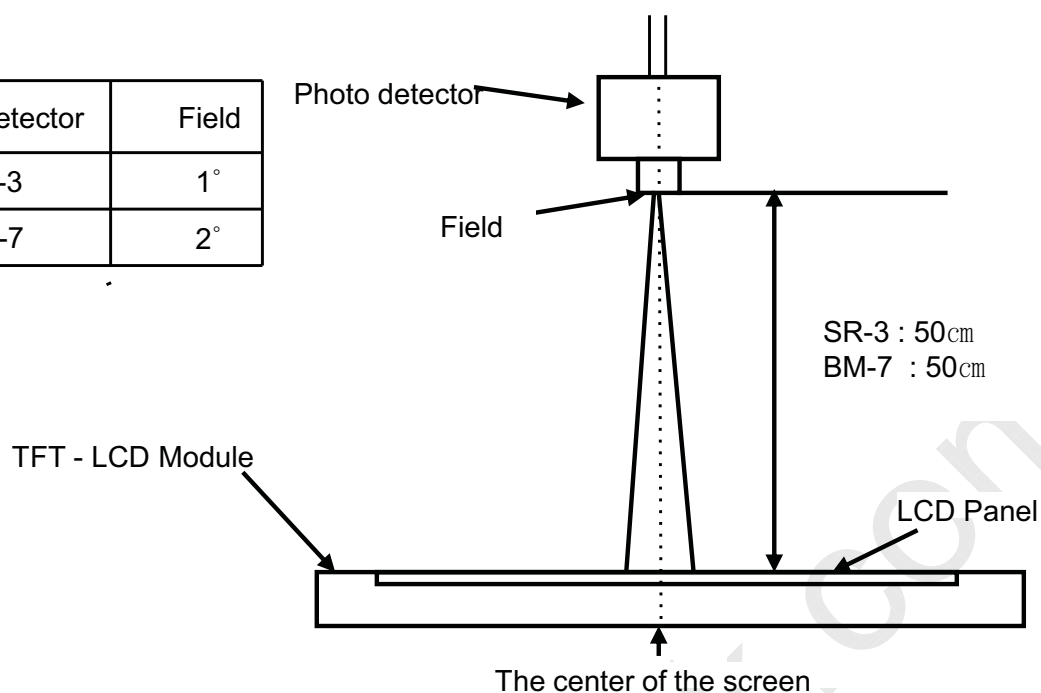
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

Single lamp current @ Vdim = 100%

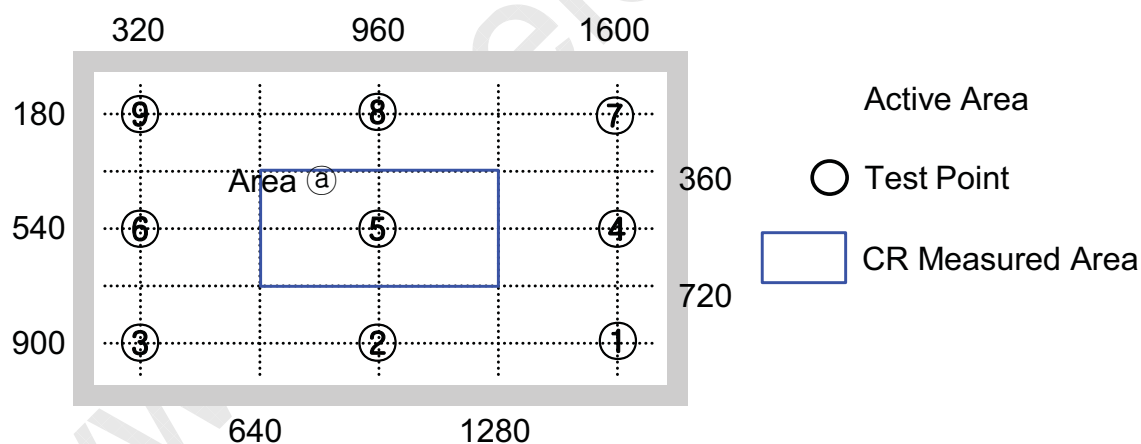
Environment condition : Ta = 25 ± 2 °C

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| Photo detector | Field |
|----------------|-------|
| SR-3 | 1° |
| BM-7 | 2° |



Note (2) Definition of test point



Note (3) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G_{\max}}{G_{\min}}$$

Gmax : Luminance with all pixels white

Gmin : Luminance with all pixels black

Note (4) Definition of 9 points brightness uniformity

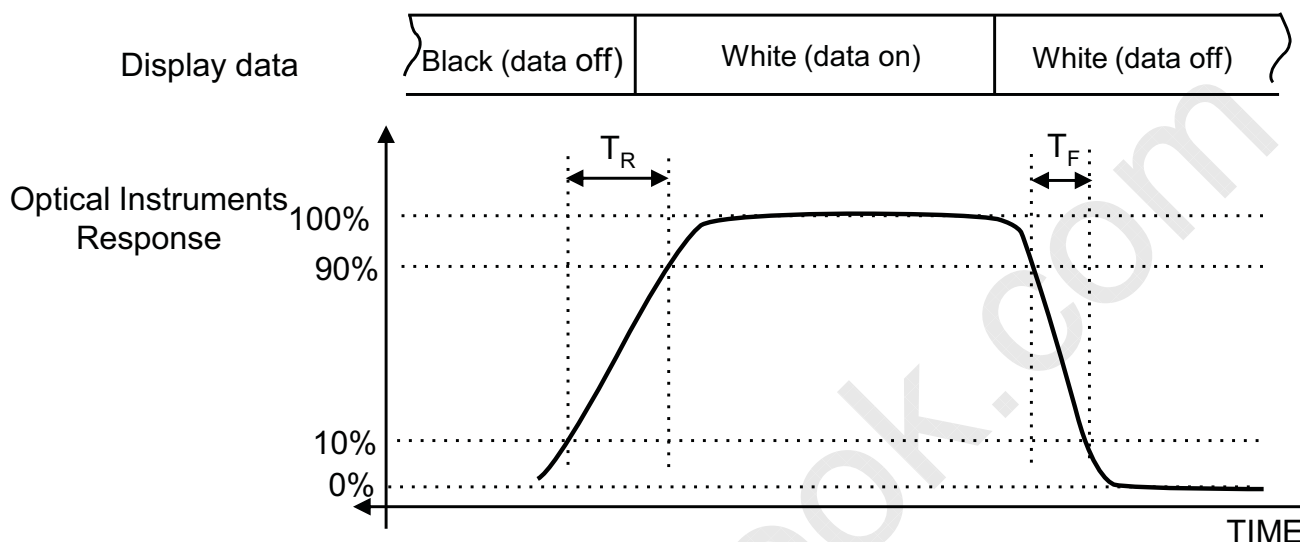
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$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

B_{max} : Maximum brightness

B_{min} : Minimum brightness

Note (5) Definition of Response time : Sum of Tr, Tf



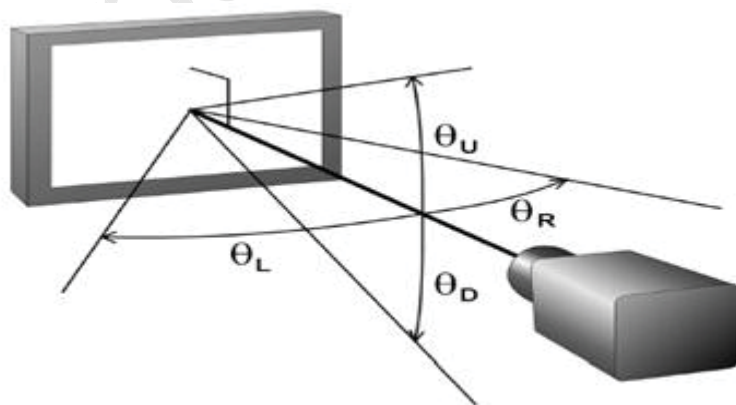
Note (6) Definition of Luminance of White : Luminance of white at center point ⑤

Note (7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤

Note (8) Definition of Viewing Angle

: Viewing angle range (C/R ≥ 10)



Note (9) Definition of 2 point Gamma

$$\text{Gamma} = \log(X_{lum}/100) / \log(Y/100)$$

$$X_{lum} = (Z - B_{min}) / (B_{max} - B_{min}) \times 100$$

Y: Measurement Level / Z: Measurement Brightness

B_{max}: Maximum Brightness / B_{min}: Minimum Brightness

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3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

$T_a = 25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

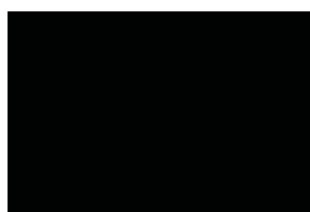
| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-------------------------|-----------------|------|-------|------|------|---------|
| Voltage of Power Supply | V_{DD} | 11 | 12 | 13 | V | (1) |
| Current of Power Supply | (a) Black | - | 450 | 900 | mA | (2),(3) |
| | (b) White | - | 470 | 920 | | |
| | (c) Mosaic | - | 470 | 920 | | |
| | (4) Max Pattern | - | 830 | 1590 | | |
| Vsync Frequency | f_V | 47 | 60 | 62 | Hz | |
| Hsync Frequency | f_H | 50 | 67.5 | 73 | kHz | |
| Main Frequency | f_{DCLK} | 130 | 148.5 | 155 | MHz | |
| Rush Current | I_{RUSH} | - | - | 3 | A | (4) |

Note (1) The ripple voltage should be controlled under 10% of V_{DD} .

(2) $f_V=60\text{Hz}$, $f_{DCLK} = 148.5\text{MHz}$, $V_{DD} = 12.0\text{V}$, DC Current.

(3) Power dissipation check pattern (LCD Module only)

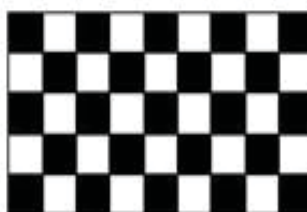
a) Black Pattern



b) White Pattern



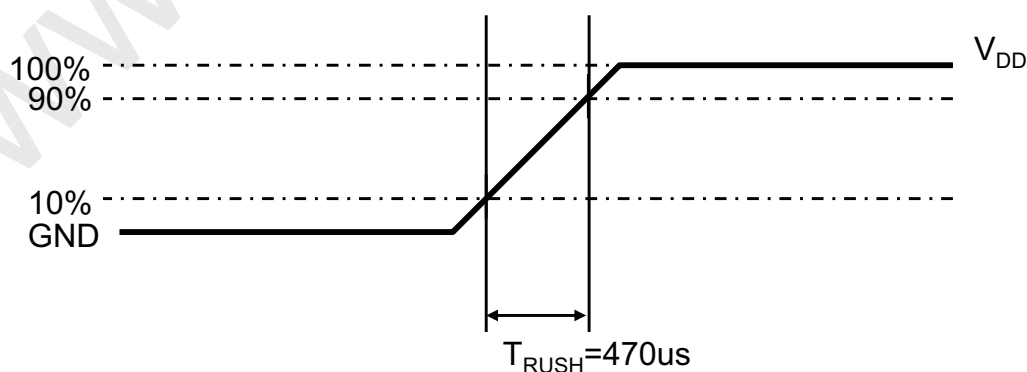
c) Mosaic



d) Max. Pattern



(4) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH} is 1ms

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3.2 Back Light Unit

The back light contains 88 LEDs.

The characteristics of lamps are shown in the following tables.

$T_a = 25 \pm 2^\circ\text{C}$

| Item | | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------------|------------|-----------------|--------|------|------|------|---|
| Operating Life Time | | Hr | 30,000 | - | - | Hour | (1) |
| Operating Current | Continuous | I _{op} | - | 130 | 260 | mA | |
| Operating Voltage | Continuous | V _{op} | 257 | - | 293 | V | @140mA / 44LEDs @T _a 25°C |
| Range of Voltage | | ΔV _f | - | - | 11.5 | V | @140mA / String |

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value at each String, I_{op}=110.0mA

[Definition of Operating Voltage : At each Strings, I_{op} = 140.0 mA (typ.)]

3.2.1 Review and Update for Electrical Specification

According to the improvement of efficiency for devices, the electrical specification would be reviewed and revised after initial values had been established. This revision mentioned above should be discussed at appropriate time.

4. Input Terminal Pin Assignment

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4.1. Input Signal & Power of Control Board

1. 51Pin Connector : FI-RNE51SZ-HF (JAE)

| PIN No. | Signal | Description | PIN No. | Signal | Description |
|---------|--------|--------------------|---------|--------|--------------------|
| 1 | Vin | Power | 26 | RE[0]P | Even LVDS Signal + |
| 2 | Vin | Power | 27 | RE[1]N | Even LVDS Signal - |
| 3 | Vin | Power | 28 | RE[1]P | Even LVDS Signal + |
| 4 | Vin | Power | 29 | RE[2]N | Even LVDS Signal - |
| 5 | Vin | Power | 30 | RE[2]P | Even LVDS Signal + |
| 6 | N.C. | No Connection | 31 | GND | GND |
| 7 | GND | GND | 32 | RECLKN | Even LVDS CLK - |
| 8 | GND | GND | 33 | RECLKP | Even LVDS CLK + |
| 9 | GND | GND | 34 | GND | GND |
| 10 | RO[0]N | Odd LVDS Signal - | 35 | RE[3]N | Even LVDS Signal - |
| 11 | RO[0]P | Odd LVDS Signal + | 36 | RE[3]P | Even LVDS Signal + |
| 12 | RO[1]N | Odd LVDS Signal - | 37 | RE[4]N | Even LVDS Signal - |
| 13 | RO[1]P | Odd LVDS Signal + | 38 | RE[4]P | Even LVDS Signal + |
| 14 | RO[2]N | Odd LVDS Signal - | 39 | GND | GND |
| 15 | RO[2]P | Odd LVDS Signal + | 40 | N.C. | No Connection |
| 16 | GND | GND | 41 | N.C. | No Connection |
| 17 | ROCLKN | Odd LVDS CLK - | 42 | N.C. | No Connection |
| 18 | ROCLKP | Odd LVDS CLK + | 43 | N.C. | No Connection |
| 19 | GND | GND | 44 | N.C. | No Connection |
| 20 | RO[3]N | Odd LVDS Signal - | 45 | N.C. | No Connection |
| 21 | RO[3]P | Odd LVDS Signal + | 46 | N.C. | No Connection |
| 22 | RO[4]N | Odd LVDS Signal - | 47 | N.C. | No Connection |
| 23 | RO[4]P | Odd LVDS Signal + | 48 | N.C. | No Connection |
| 24 | GND | GND | 49 | N.C. | No Connection |
| 25 | RE[0]N | Even LVDS Signal - | 50 | N.C. | No Connection |
| | | | 51 | SEL1 | LVDS Option |

■ Option Pin Description

These pins are CMOS interface.

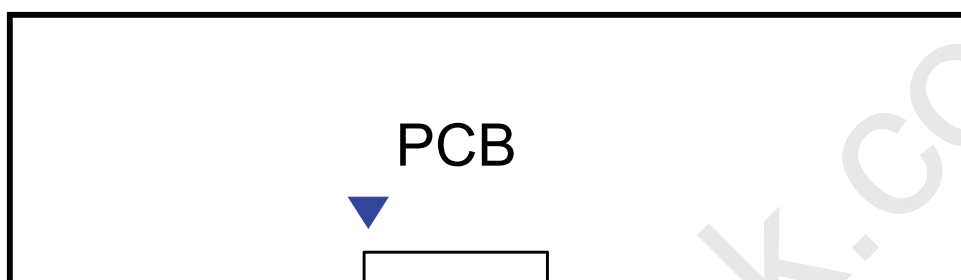
Please use within the range of the following restriction.

VIH : 2.4V(min) / 3.5V(max)

VIL : 0.0V(min) / 0.4V(max)

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Note(1) Pin number starts from Right side



A. 51 Pin

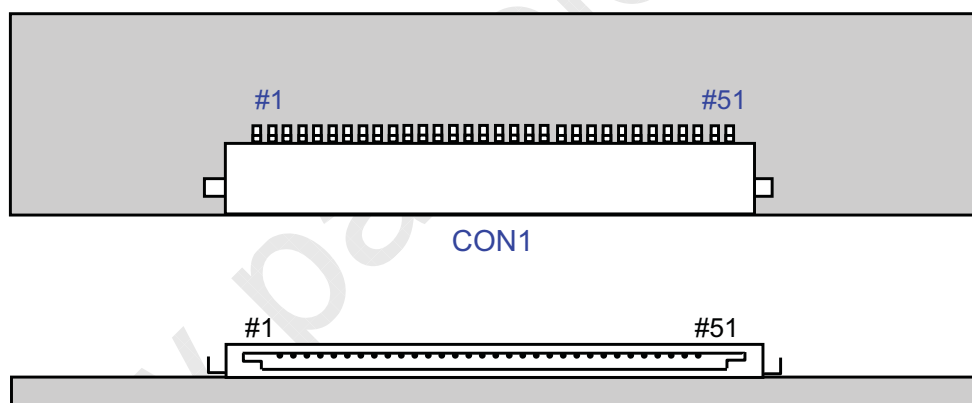


Fig. Connector diagram

- All GND pins should be connected together and also be connected to the LCD's metal chassis.
- All power input pins should be connected together.
- All NC pins should be separated from other signal or power.

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4.2. LS Bar Input Pin Configuration

1. CONNECTOR : Morex/51103-040

| Pin | Pin Configuration (Function) |
|-----|------------------------------|
| 1 | DC Voltage (+) |
| 2 | N.C. |
| 3 | N.C. |
| 4 | DC Voltage (+) |

2. CONNECTOR : Morex/51103-0500

| Pin | Pin Configuration (Function) |
|-----|------------------------------|
| 1 | Feedback |
| 2 | N.C. |
| 3 | N.C. |
| 4 | Feedback |
| 5 | N.C. |



4.3 LVDS Interface

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| | LVDS pin | Odd Data | Even Data |
|-------------|--------------|----------|-----------|
| TxOUT/RxIN0 | TxIN/RxOUT0 | R0 | R0 |
| | TxIN/RxOUT1 | R1 | R1 |
| | TxIN/RxOUT2 | R2 | R2 |
| | TxIN/RxOUT3 | R3 | R3 |
| | TxIN/RxOUT4 | R4 | R4 |
| | TxIN/RxOUT6 | R5 | R5 |
| | TxIN/RxOUT7 | G0 | G0 |
| TxOUT/RxIN1 | TxIN/RxOUT8 | G1 | G1 |
| | TxIN/RxOUT9 | G2 | G2 |
| | TxIN/RxOUT12 | G3 | G3 |
| | TxIN/RxOUT13 | G4 | G4 |
| | TxIN/RxOUT14 | G5 | G5 |
| | TxIN/RxOUT15 | B0 | B0 |
| | TxIN/RxOUT18 | B1 | B1 |
| TxOUT/RxIN2 | TxIN/RxOUT19 | B2 | B2 |
| | TxIN/RxOUT20 | B3 | B3 |
| | TxIN/RxOUT21 | B4 | B4 |
| | TxIN/RxOUT22 | B5 | B5 |
| | TxIN/RxOUT24 | HSYNC | HSYNC |
| | TxIN/RxOUT25 | VSYNC | VSYNC |
| | TxIN/RxOUT26 | DEN | DEN |
| TxOUT/RxIN3 | TxIN/RxOUT27 | R6 | R6 |
| | TxIN/RxOUT5 | R7 | R7 |
| | TxIN/RxOUT10 | G6 | G6 |
| | TxIN/RxOUT11 | G7 | G7 |
| | TxIN/RxOUT16 | B6 | B6 |
| | TxIN/RxOUT17 | B7 | B7 |
| | TxIN/RxOUT23 | Reserved | Reserved |
| TxOUT/RxIN4 | TxIN/RxOUT28 | R8 | R8 |
| | TxIN/RxOUT29 | R9 | R9 |
| | TxIN/RxOUT30 | G8 | G8 |
| | TxIN/RxOUT31 | G9 | G9 |
| | TxIN/RxOUT32 | B8 | B8 |
| | TxIN/RxOUT33 | B9 | B9 |
| | TxIN/RxOUT34 | Reserved | Reserved |

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4.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

| COLOR | DISPLAY (10bit) | DATA SIGNAL | | | | | | | | | | | | | | | | | | | | | | | | | | | | GRAY SCALE LEVEL | | |
|------------------------------|--------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------------------|--------|--------------|
| | | RED | | | | | | | | | | GREEN | | | | | | | | | | BLUE | | | | | | | | | | |
| | | R 0 | R 1 | R 2 | R 3 | R 4 | R 5 | R 6 | R 7 | R 8 | R 9 | G 0 | G 1 | G 2 | G 3 | G 4 | G 5 | G 6 | G 7 | G 8 | G 9 | B 0 | B 1 | B 2 | B 3 | B 4 | B 5 | B 6 | B 7 | | B 8 | B 9 |
| BASIC COLOR | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | |
| | CYAN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | |
| | MAGENTA | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| | YELLOW | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| | WHITE | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - |
| GRAY SCALE OF RED | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 | |
| | DARK ↑ | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 |
| | | : | : | : | : | : | : | | | | : | : | | : | : | : | : | | | | | : | : | | : | : | : | | : | | | R3~ R1020 |
| | | : | : | : | : | : | : | | | | : | : | | : | : | : | : | | | | | : | : | | : | : | : | | : | | | |
| | ↓ LIGHT | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1021 |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1022 |
| | RED | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1023 |
| GRAY SCALE OF GREEN | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G0 |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 |
| | | : | : | : | : | : | : | | | | : | : | : | : | : | : | : | | | | | : | : | | : | : | : | | : | | | G3~ G1020 |
| | | : | : | : | : | : | : | | | | : | : | : | : | : | : | : | | | | | : | : | | : | : | : | | : | | | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1021 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1022 |
| | GREEN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1023 |
| GRAY SCALE OF BLUE | BLACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B0 | |
| | DARK ↑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B2 |
| | | : | : | : | : | : | : | | | | : | : | : | : | : | : | : | | | | | : | : | : | : | : | : | | : | | | B3~ B1020 |
| | | : | : | : | : | : | : | | | | : | : | : | : | : | : | : | | | | | : | : | : | : | : | : | | : | | | |
| | ↓ LIGHT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B1021 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B1022 |
| | BLUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B1023 |

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

5. Interface Timing

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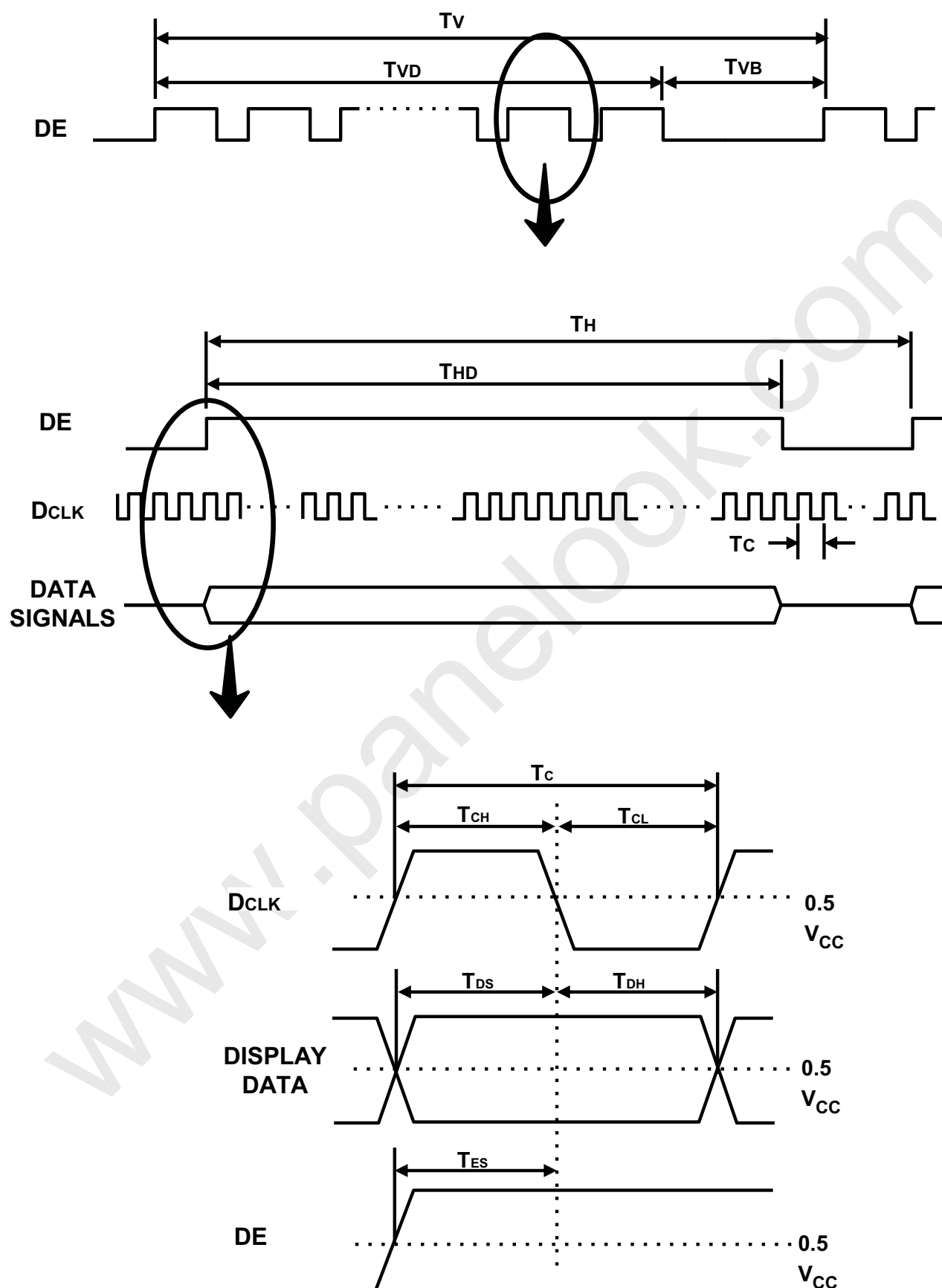
5.1 Timing Parameters

5.1.1 DE Mode

| SIGNAL | ITEM | SYMBOL | MIN. | TYP. | MAX. | Unit | Note |
|----------------------|---------------------|--------|--------|--------|--------|--------|------------------------|
| Clock | Frequency | 1/Tc | 130.00 | 148.50 | 155.00 | MHz | |
| Hsync | | FH | 50 | 67.5 | 73 | kHz | Polarity : Negative |
| Vsync | | FV | 47 | 60 | 63 | Hz | Polarity : Negative |
| Vertical Active | Display Period | TVD | 1080 | 1080 | 1080 | Lines | |
| | Vertical Total | TV | 1100 | 1125 | 1480 | Lines | |
| Horizontal Active | Display Period | THD | 1920 | 1920 | 1920 | clocks | |
| | Horizontal Total | TH | 2145 | 2200 | 2450 | clocks | |

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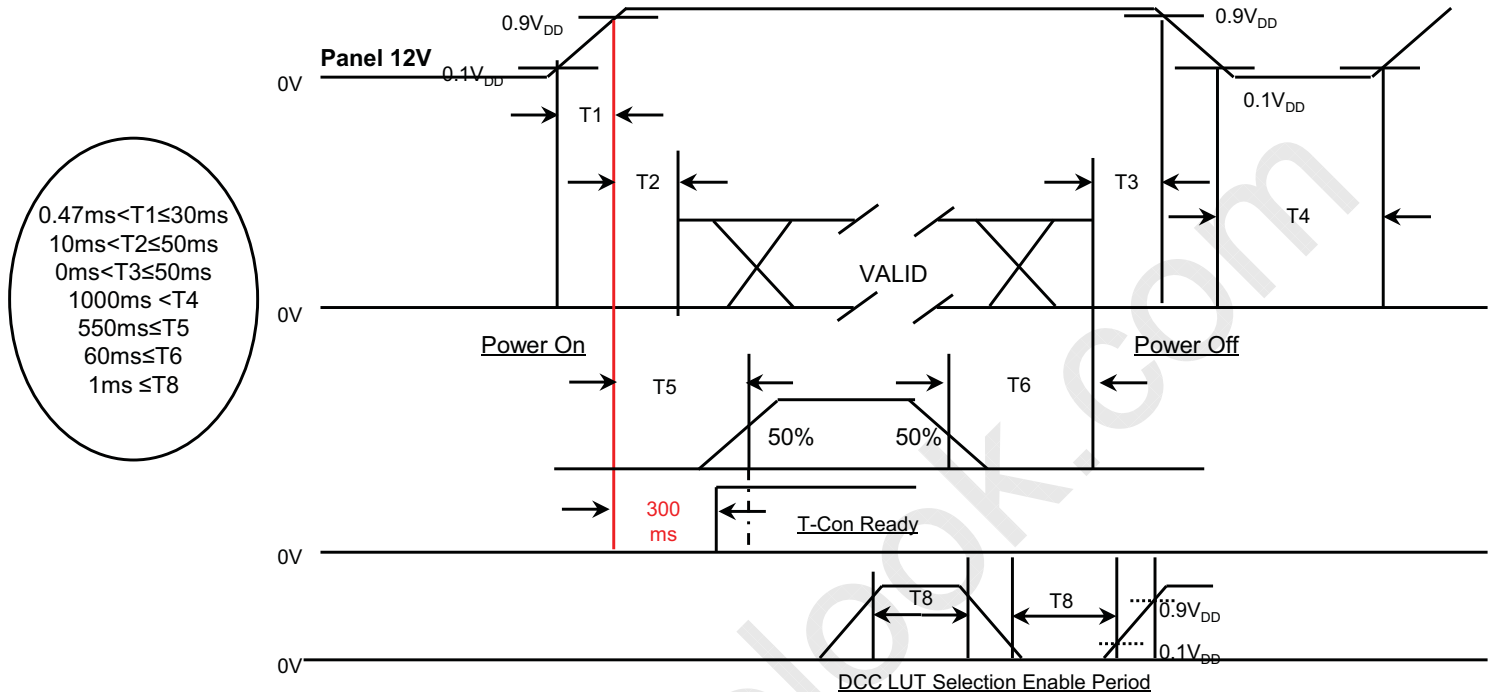
5.2 Timing diagrams of interface signal (DE only mode)



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5.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



T1 : V_{DD} rising time from 10% to 90%
 T2 : The time from V_{DD} to valid data at power ON.
 T3 : The time from valid data off to V_{DD} off at power Off.
 T4 : V_{DD} off time for Windows restart
 T5 : The time from valid data to B/L enable at power ON.
 T6 : The time from valid data off to B/L disable at power Off.
 T8 : DCC LUT Selection Enable Period.

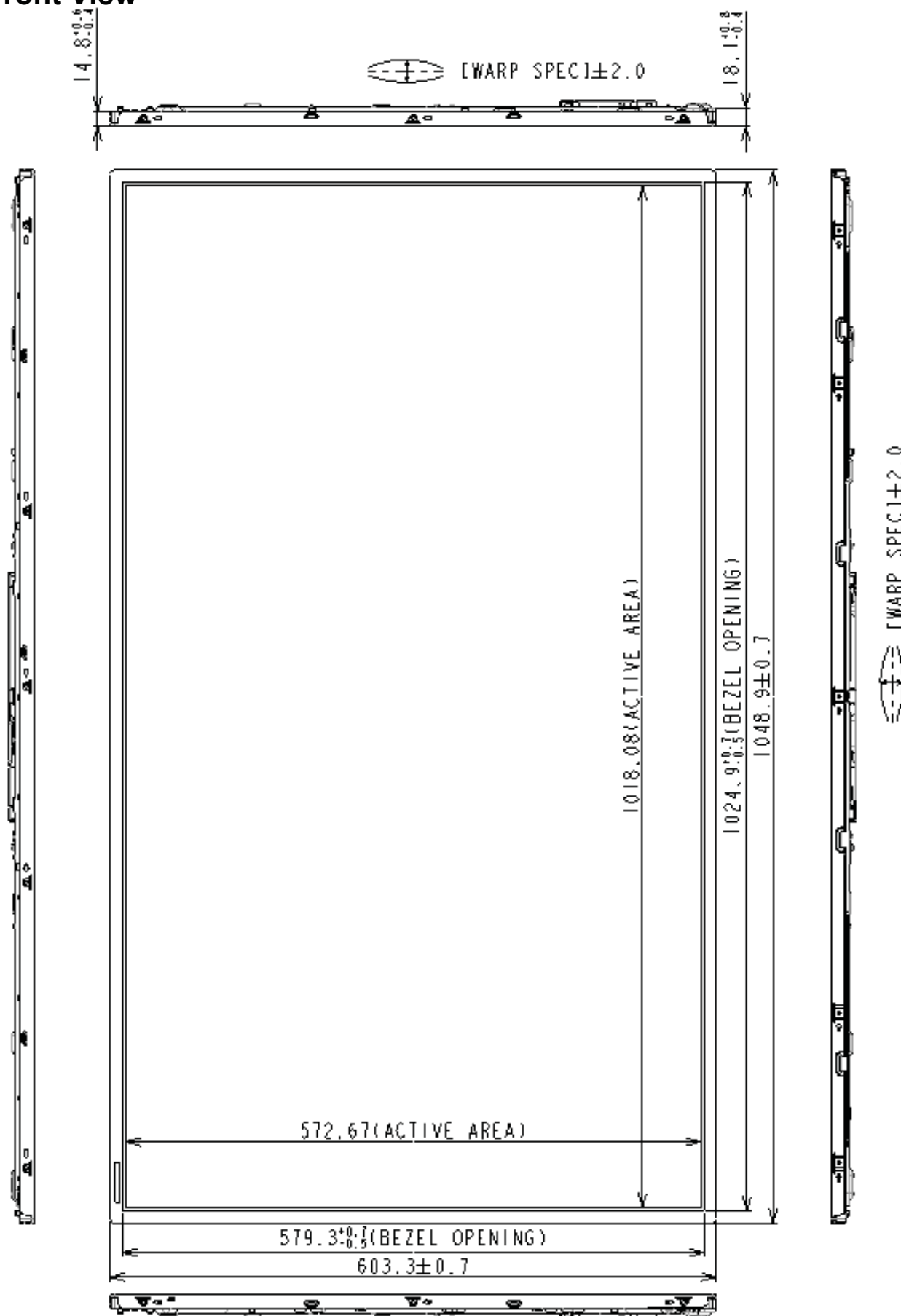
[Valid Data Condition]

1. Input LVDS signals must satisfy "Interface Timing" Specification on p23.
2. LVDS Clock must keep the same frequency.
3. "Temp SEL" signal should be changed within Tcon Reset and Tcon Ready.
4. Data signal should not input during "Fail Safe Mode".

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD} .
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.

6.1 Outline Dimension

a. Front View

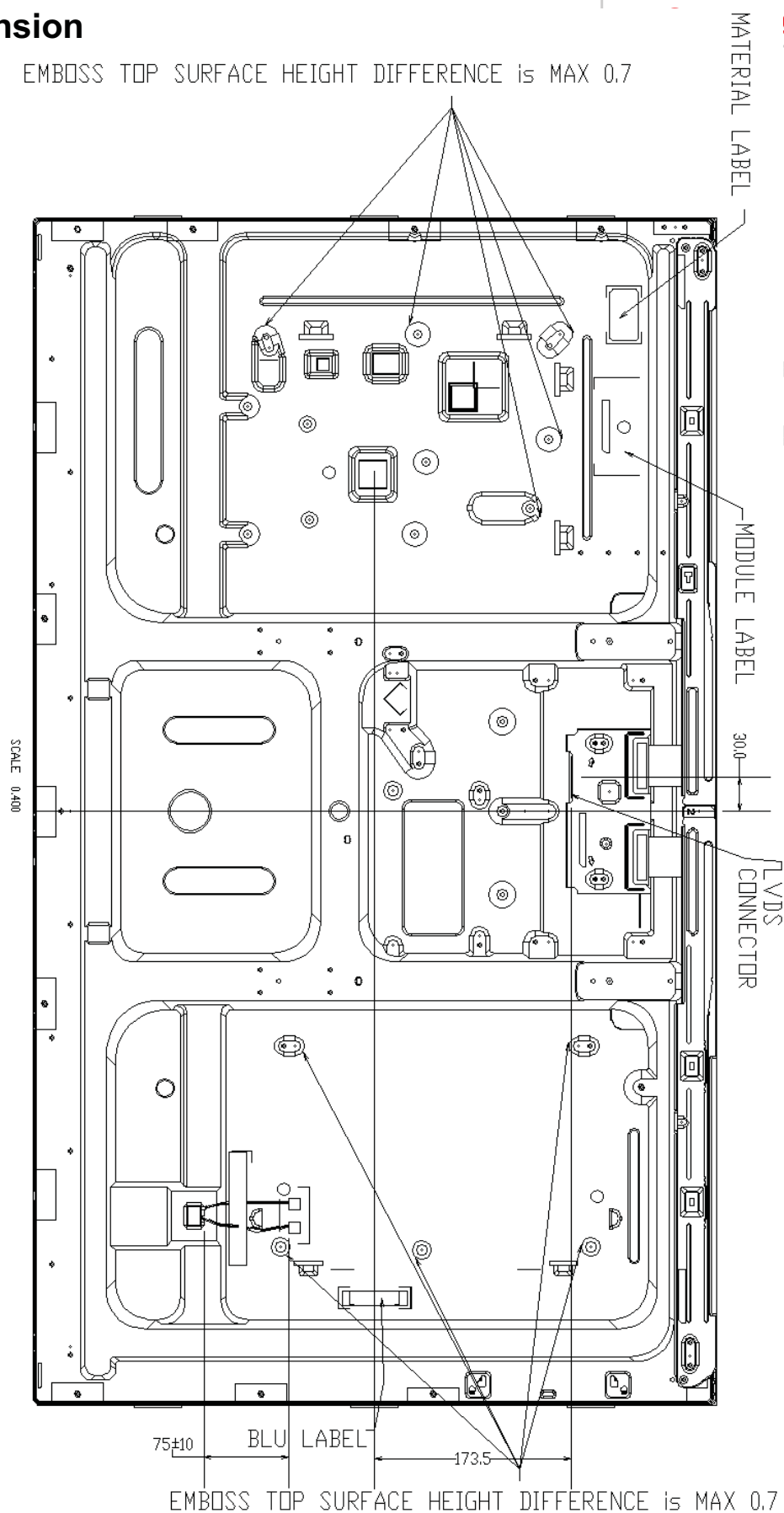
Samsung Secret

6.1 Outline Dimension

b. Rear View

EMBOSS TOP SURFACE HEIGHT DIFFERENCE is MAX 0.7

g Secret



* TAPE TO HOLD CABLE SHALL BE FOLDED
TO ENABLE TO BE REMOVED EASILY.

MODEL

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7. PACKING

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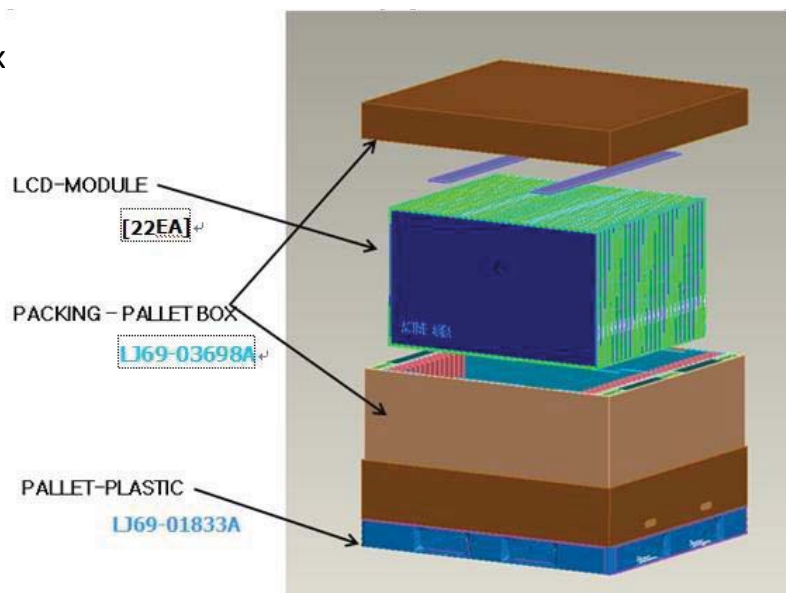
7.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method

Packing Box



7.2 Packing Specification

| Item | Specification | Remark |
|---------------------|---------------------------------------|--|
| LCD Packing | 22ea / (Packing Box) | 1. 220kg/LCD(22ea) 2. 28kg/Packing Box(1ea) 3. Packing Box Material : Paper |
| Desiccant (Drier) | 6ea / LCD | 10g/ea, Cobalt-dichloride-free |
| Pallet | 1Box / Pallet | Pallet weight : 7.8kg |
| Packing Direction | Vertical | - |
| Total Pallet Size | L x W x Height | 1270mm x 1150mm x 785mm |
| Total Pallet Weight | 257kg | Pallet(7.8kg) + Module(22 x 10kg = 220kg) + Packing BOX(28kg) + Desiccant(0.06kg x 22 = 1.32kg) |
| Stack Layer | - | |
| Shielding Bag | Compound PE / Sealing / 70 μ m | Material / Adhesive tape / Thickness |
| POL Protection Film | PET / 0.125mm | Material / Thickness |

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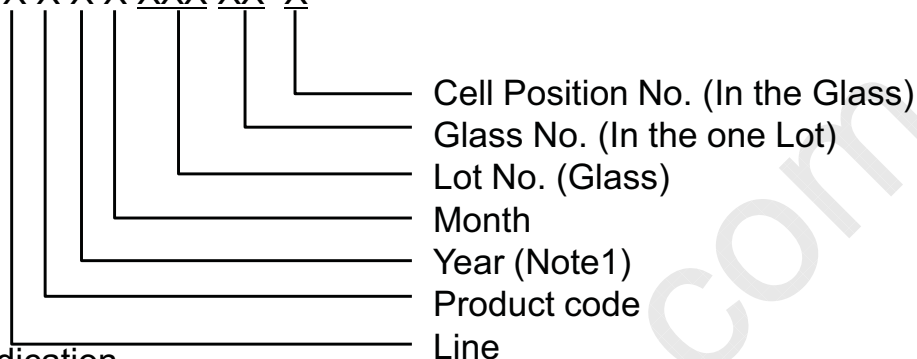
8. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

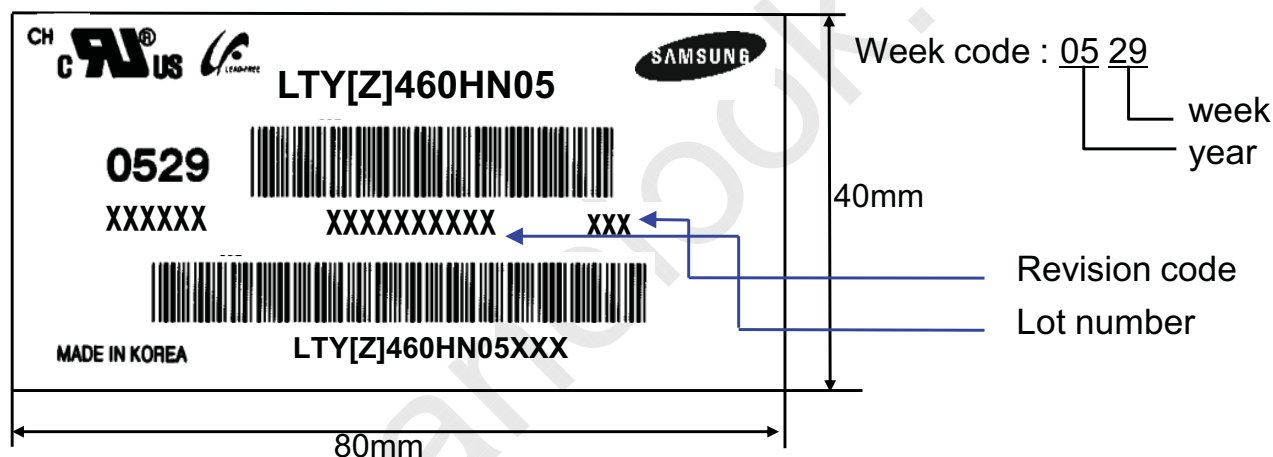
(1) Parts number : LTY[Z]460HN05-XXX

(2) Revision: One letters

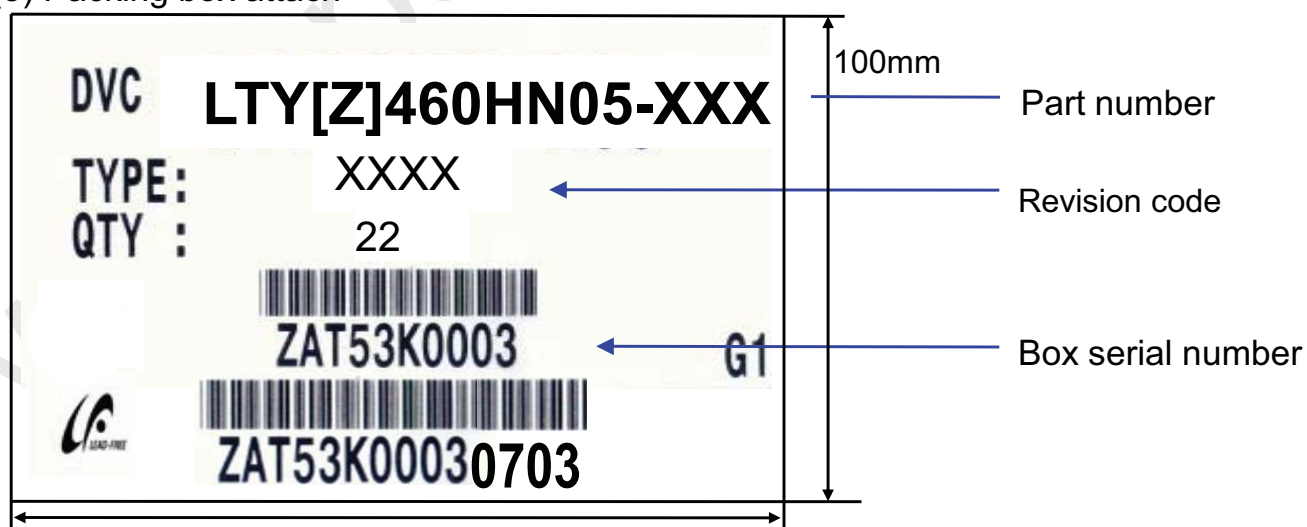
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

1. After service part

Lamps cannot be replaced because of the narrow bezel structure.

9. General Precautions

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9.1 Handling

- (a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.
- (b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.
- (c) Refrain from strong mechanical shock and / or any force to the Module.
In addition to damage, this may cause improper operation or damage to the Module and back light.
- (d) Note that polarizers are very fragile and could be damage easily.
Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.
- (g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.
- (i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble the Module.
- (l) Do not pull or fold the LED FFC.
- (m) Do not adjust the variable resistor located on the Module.
- (n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (o) Pins of I/F connector should not be touched directly with bare hands.

9.2 Storage

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We highly recommend to comply with the criteria in the table below.

| Item | Unit | Min. | Max. |
|---------------------|---|------|------|
| Storage Temperature | (°C) | 10 | 40 |
| Storage Humidity | (%rH) | 35 | 75 |
| Storage Life | 12 Months | | |
| Storage Condition | <ul style="list-style-type: none"> - The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20 °C and a humidity of 50% for 24 hours. | | |

9.3 Operation

- (a) No Connection or disconnect the Module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- (d) The cable between the back light connector and its Converter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of LED and may require higher startup voltage(Vs).

9.4 Operation Condition Guide

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(a) The LCD product should be operated under normal conditions.

Normal condition is defined as below;

- Temperature : $20 \pm 15^{\circ}\text{C}$
- Humidity : $55 \pm 20\%$
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

9.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.